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Federal Communications Commission
Office of the Secretary

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

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Federal Communications Commission
Office of the Secretary

In the Matter Of:	)	
	)	GEN Docket No. 90-314
Amendment of the Commission's	)	ET Docket No. 92-100
Rules to Establish New Personal	)	
Communications Services	)	RM-7140, RM-7175, RM-7617, RM-7618,
	)	RM-7760, RM-7782, RM-7860, RM-7977,
	)	RM-7978, RM-7979, RM-7980
	)	
	)	PP-35 through PP-40, PP-79 through PP-85

COMMENTS OF MOTOROLA INC.

Motorola Inc. ("Motorola") herewith submits its comments in the above-captioned proceeding concerning new Personal Communications Services ("PCS"). The Notice of Proposed Rulemaking ("Notice") recognizes that our nation is poised upon the brink of a remarkable technological revolution in wireless telecommunications. As detailed below, prompt Commission action is the key to unlocking the enormous benefits of these advances for our country's consumers and businesses. Accordingly, these comments offer suggestions for expediting the advent of new PCS services and maximizing the realization of their fullest potential.

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EXECUTIVE SUMMARY

• SWIFT COMMISSION ACTION FINALIZING PCS ALLOCATIONS AND RULES IS ABSOLUTELY ESSENTIAL TO THE CONTINUED COMPETITIVENESS OF U.S. WIRELESS TELECOMMUNICATIONS USERS AND MANUFACTURERS.

• MOTOROLA SUPPORTS THE ALLOCATION OF SPECTRUM WITHIN 1850-1970 FOR LICENSED AND NONLICENSED PCS. THE 1970-1990 BAND SEGMENT SHOULD BE RETAINED FOR MSS, CONSISTENT WITH REGION II WARC-92 ACTIONS.

• TRUE COMPETITION OCCURS WHEN CONSUMERS HAVE THE OPTION TO CHOOSE FROM A NUMBER OF SERVICE OPTIONS. MOTOROLA RECOMMENDS A BALANCED 1.8 GHZ BANDPLAN DETAILED IN SECTION II OF THESE COMMENTS WHICH MAXIMIZES SPEED OF DEPLOYMENT, ENCOURAGES A DIVERSITY OF SERVICES AND INCREASES OPPORTUNITIES FOR SMALL ENTREPRENEURS.

•THE COMMISSION SHOULD ULTIMATELY ENDORSE INDUSTRY DEVELOPED LICENSED PCS COMMON AIR INTERFACE STANDARDS AND NONLICENSED ETIQUETTES AS A CONDITION FOR 1.8 GHZ PCS OPERATION.

• MOTOROLA'S PROPOSED 900 MHZ BANDPLAN WILL PROVIDE FOR MORE ECONOMICAL AND SPECTRUM EFFICIENT NARROWBAND PCS OPERATION .

• ALL MANUFACTURERS OF NONLICENSED DEVICES SHOULD SHARE THE COST OF RELOCATING INCUMBENT MICROWAVE USERS; MOTOROLA PROPOSES A MECHANISM FOR DOING SO IN SECTION VI OF THESE COMMENTS.

• MOTOROLA SUPPORTS IMPROVEMENTS TO THE APPLICATION AND LOTTERY PROCESS WHICH MAXIMIZE OPPORTUNITIES FOR SERIOUS CONTENDERS AND MINIMIZE RAMPANT SPECULATION.

• THE PROPOSED PCS/MICROWAVE COORDINATION TABLE SHOULD BE EXTENDED TO INCLUDE LOWER POWERS AND ANTENNA HEIGHTS APPLICABLE TO PCS SYSTEMS.

I. INTRODUCTION

The Notice represents a critical step " towards making personal communications services (PCS) a reality," ¶1. In initiating this proceeding, the Commission recognizes that "[s]ignificant technological advances have expanded substantially the number and types of wireless telecommunications services that can be made available to the American people," ¶3. A host of new services are in the offing that include advanced forms of portable wireless coverage, including vehicular and pedestrian services, portable facsimile services, wireless PBXs, wireless local area networks and advanced messaging services.

The family of PCS services contemplated in the Notice "are potentially revolutionary," and will significantly improve both the flexibility and functionality of existing domestic communications networks, ¶3. By serving telecommunications users' needs more effectively, new PCS services have the potential to "increase productivity and efficiency across a broad array of industries and have a positive impact on the international competitiveness of the Nation's economy," ¶4. PCS has the capability to provide key communications tools to the more than 150 million domestic wireless users estimated in the year 2000.

Motorola and others in industry have already committed vast resources in technology development to provide spectrally efficient, cost effective communications solutions required for the next decade and beyond. Last year alone, Motorola invested over one billion dollars in technology research and development. Until now,

however, the lack of new spectrum allocations for advanced wireless services have placed domestic manufacturers at a severe disadvantage.

In Europe and Asia, governments have moved ahead rapidly to free large blocks of spectrum for new communications technologies to give local suppliers a head start in satisfying both the home market and global market demand. Consequently, expeditious action on the Notice is critical for America's traditional successes in exporting communications technologies, services and expertise to be continued for new advanced systems.

In this regard, the Notice is a sound basic framework within which to offer users new and competitive wireless services at reasonable costs. The foundation for the future, as set forth in the Notice, is an "attempt to optimize and balance four key values in providing spectrum and a regulatory structure for PCS: 1) universality; 2) speed of deployment; 3) diversity of services; and 4) competitive delivery," ¶6. Motorola also concurs that the Commission should avoid "becom[ing] bogged down in a regulatory morass that may delay the delivery, or even threaten the existence, of PCS," ¶7.

Motorola's comments offer suggestions designed to optimize realization of the Commission's four key goals for the various types of PCS services. First, Motorola discusses factors leading to its recommended alternative 1.8 GHz bandplan which accommodates both licensed and nonlicensed PCS services while maintaining the Commission's option to propose subsequent allocations for mobile satellite services,

consistent with Region II decisions reached at WARC-92. Notably, the specific bandplan ultimately adopted also has a great impact on whether PCS licensees have sufficient opportunity to initiate competitive services quickly in the populated microwave environment.

Motorola also strongly supports the proposed 900 MHz allocations for narrowband PCS services. However, spectral efficiency would be enhanced and infrastructure costs could be lowered, if the Commission were to adopt Motorola's band plan for narrowband services. The plan is based on the understanding that narrowband services may have talk in times from the mobile/portable that may be the same (symmetrical) or in many cases less (asymmetrical) than talk out times from the base station. These technologies support a diverse range of new services with a combination of functionality and price unmatched by any other mobile service.

Motorola believes that adoption of its proposed bandplans for use of 2 GHz and 900 MHz spectrum would facilitate prompt deployment of a diverse range of economically viable and competitive PCS services supported by a broad range of manufacturers and potential service providers.

In furtherance of these objectives, Motorola recommends the Commission ultimately endorse industry developed common air interface standards and nonlicensed PCS etiquettes to promote competitive and universal services for 1.8 GHz PCS consumers. The benefits of offering users of public systems the capability to

roam across systems in different areas or even among competitive systems within a given area should not be underestimated.

In addition, our comments provide a number of technical recommendations for both the 1.8 and 900 MHz bands which will assist the Commission and the industry in realizing the four key values enumerated in the Notice for PCS. These include issues related to PCS-to- microwave coordination and protection, prediction of PCS coverage, power levels for both 1.8 GHz and 900 MHz PCS, and 900 MHz emission masks.

The Commission's Emerging Technology decision to rely primarily on voluntary microwave relocation through compensation raises critical issues for incumbent users and manufacturers of non-licensed PCS devices. As multiple manufacturers will support the potentially enormous market for nonlicensed PCS devices, the Commission must clearly establish some mechanism for manufacturers to deal collectively and on an equitable basis with relocating microwave users. In Section VI of these comments, Motorola suggests a possible mechanism establishing a consortium, open to all manufacturers, through which all beneficiaries of the allocation would bear a fair, pro rata share of relocation costs.

Finally, Motorola believes that substantive reforms to the licensing mechanism will be necessary to ensure that the deployment of PCS services is not delayed by

speculators. Motorola outlines recommended changes in Section VII of these comments.

II. BANDPLANS TO JUMPSTART COMPETITIVE PCS SERVICES

A. 1.8 GHz PCS Bandplan

Motorola's alternative PCS bandplan for 1.8 GHz is designed to maximize the variety and number of PCS services within the constraints of available spectrum. This bandplan differentiates services along natural boundaries and achieves efficiencies through such groupings. Motorola has endeavored to create a blueprint for PCS which accommodates multiple technologies, avoids unduly constraining the classes of services that can be offered within each allocation, and provides sufficient regulatory structure to attract capital.

The manner in which the Commission allocates the spectrum, or devises the bandplan, is the most critical in the set of decisions that will set the course for PCS. While service rules may change significantly over time, basic spectrum allocation and assignment decisions do not change without great deliberation and difficulty.
Further, the decisions made regarding the band plan must be carefully weighed to provide the highest probability of success for the entire range of services envisioned for personal communications. Services devoid of structure ultimately do not instill the requisite level of confidence needed to attract the significant investment required to yield success.

In Motorola's view, generic personal communications can be broken down into four functional service segments. These are: (1) public access services providing ubiquitous worldwide coverage as would be provided by a low earth orbit satellite system; (2) public access services providing ubiquitous wide area coverage as provided by a terrestrial based cellular system; (3) public access pedestrian services as provided by microcellular systems; and (4) private access systems providing in-building and campus coverage. [1] These services may be offered by the same system operator or the subscriber devices may bridge various service offerings. An example of this approach is the PPS 800 market test in which Motorola is participating.

It is imperative that the regulatory process not abandon the historically successful need for service differentiation. We wholeheartedly support the concept of flexibility. However, we cannot embrace a regulatory environment which is completely devoid of structure and which increases the potential for chaos and the risk that sufficient investment will be denied.

Therefore, we propose the following 1.8 GHz bandplan which addresses the various service segments outlined above, provides the proper degree of regulatory

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[1]Though we understand that mobile satellite services (MSS) are being addressed in separate proceedings, we include a description of that service segment to place our recommended bandplan in complete context. As noted in the Commission's PCS Notice, WARC-92 decisions specifically included the 1970-1990 MHz band segment as part of additional Region II spectrum allocations for MSS.

structure needed for success, and meets the Commission's four key goals of universality, speed of deployment, diversity of services and a competitive structure:

BLOCK	SPECTRUM SEGMENT (MHZ)
A	1850-1870/1930-1950
B	1870-1890/1950-1970
C	1890-1900
D	1900-1910
E	1910-1930

- **BLOCKS A AND B ARE PAIRED SEGMENTS, 40 MHZ PER OPERATOR, PROVIDING WIDE AREA UBIQUITOUS PCS PUBLIC ACCESS SERVICES WITH POWER LIMITS AS OUTLINED IN SECTION IV OF OUR COMMENTS.**
- **BLOCK C IS AN UNPAIRED 10 MHZ SEGMENT WHICH WOULD BE SHARED BY TWO LICENSEES, PROVIDING INCREASED OPPORTUNITY FOR SMALL ENTREPRENEURS TO ENTER PCS.**
- **BLOCK D IS ALSO AN UNPAIRED 10 MHZ SEGMENT WHICH COULD BE SHARED BY MULTIPLE LICENSEES OR TO EXPAND THE SPECTRUM PROPOSED FOR NONLICENSED PCS.**
- **BLOCK E IS AN UNPAIRED 20 MHZ SEGMENT FOR NONLICENSED PCS AS PROPOSED BY THE COMMISSION**

In developing this plan, Motorola was guided by several practical considerations which impact one or more of the Commission's four goals.

The United States delegation, including the Commission, fought hard at WARC-92 to provide the option for additional mobile satellite service (MSS) allocations. As a result, Region II allocation decisions provide the Commission with the option to use the 1970-2010/2160-2200 MHz bands for MSS.

MSS is an important member of the generic family of personal communications services. Coverage that would be provided by LEO systems such as Iridium will provide a layer of universality that cannot be matched by terrestrial based or geosynchronous satellite systems. Therefore, Motorola's bandplan retains the Commission's option to issue subsequent proposals for low earth orbit satellite personal communications services above 1970 MHz, consistent with decisions reached at WARC-92.

An extremely critical element in developing our recommended plan was the need to maximize the potential for PCS providers to at least initiate service in the occupied spectrum environment while incumbent microwave users are gradually reaccommodated in reliable alternative spectrum. This entails 1) providing each licensee sufficient spectrum in which to initiate competitive services in the shared environment; and 2) positioning each licensee's spectrum segment in the band to

simplify, to the extent possible, the negotiation process for relocating microwave incumbents. The direct benefit of Motorola's alternative approach is to increase the speed of deployment.

Most microwave systems in the 1.8 GHz band are licensed on the basis of 10 MHz paired channels. In general, the microwave protection criteria used today limits assignment of directly adjacent microwave channels in the same specific localized area. Therefore, if one 10 MHz channel is licensed, the next adjacent 10 MHz channel stands a higher probability of being available to support PCS service on a shared basis in the same localized area. Maintaining each block assigned to a given licensee as an integral multiple of 10 MHz also should simplify the negotiation process as compared to the Commission's proposed plan using 15 MHz segments.

Motorola's recommended 1. 8 GHz bandplan provides 40 MHz per paired assignment. In our view, this maximizes, within the constraints of the limited spectrum available, the potential to initiate service on a shared basis with incumbent microwave licensees. These allocations will provide licensees the ability to initiate competitive portable services, with both vehicular and pedestrian coverage.

Dedicated unpaired licensed spectrum is ideal for consumer focused, low cost pedestrian types of services and is also necessary to meet the Commission's four goals. Based on discussions with a number of potential PCS providers, Motorola is not alone in its belief that these services are an important component of personal

communications and that dedicated spectrum is needed to ensure their delivery. This type of service, when used in conjunction with in-building non-licensed private access systems, will appeal to users whose needs require a different set of solutions or economic capabilities. Further, Motorola has a system design which allows two operators to share successfully a 10 MHz block of spectrum.

Targeting a segment of the licensed PCS spectrum for a consumer focused, low cost pedestrian service will accrue other benefits as well. Capital investment will be significantly lower, providing for a diversity of investors, both small and large. Furthermore, to increase the level of entrepreneurial opportunity, we propose that these licenses be assigned on a basic trading area basis as put forth by the Commission's Notice.

20-MHz of Spectrum is a Sound Starting Point for Non-Licensed PCS Devices

The Commission proposes to allocate spectrum in the 1910-1930 MHz band for a new family of non-licensed PCS devices. The Notice concludes that these devices "will be particularly useful for the transmission of high and low speed data between computing devices, cordless telephone and wireless "PBX's" ¶41. The Commission's goal is to "foster the rapid introduction of new PCS technologies by permitting manufacturers to experiment with and directly market to the general public, products using new designs and technologies, without the delays associated with the licensing of radio service, "id.

Motorola strongly concurs with the Commission's believe that spectrum for new nonlicensed telecommunications devices can provide an early and important consumer dividend through advanced PCS capabilities. The exponential growth in cordless telephones alone provides a strong indicator of the enormous market for such products. Moreover, PCS market forecasts confirm the breadth and scope of public demand for new and improved offerings.

Motorola also strongly supports the Commission's plans for an initial 20 MHz allocation at 1910-1930 MHz for nonlicensed "User PCS" devices. This band contains far fewer existing 2 GHz fixed microwave links than encountered in other portions of the 1850-1990 MHz band. Studies of the band show that approximately 450 facilities are licensed in these frequencies nationwide, far lighter than microwave usage in other portions of the band.

This lower level of utilization by 2 GHz fixed users is particularly important for several reasons. Motorola believes that the deployment of nonlicensed PCS devices will require exclusive use of spectrum. Unlike traditional services licensed exclusively for operation in specific service areas, the products offered in this band will be under exclusive control of end-user customers who cannot be confined to pre-designated areas of operation. Therefore, this equipment can be used at any location in any part of the country, irrespective of a manufacturer's best intentions to confine its use to a

specific locale. [2] The fewer the number of fixed microwave users in the spectrum band, the faster and easier will be the deployment of nonlicensed PCS products and offerings.

Motorola simulations on circuit-switched applications confirm that at least 10 MHz of spectrum will be needed to support business voice applications. Further, at least 10 MHz for packet-switched data will be needed to support data rates as high as 10 Megabits per second. For multiple data systems to operate in the same location simultaneously, of course, additional spectrum may be required. Also, the need for data transmission capacity is expected to grow dramatically as software applications are developed to utilize the communications capability offered by this new spectrum allocation.

As noted in the description of our bandplan, one option for the 1900-1910 MHz band segment is to extend the 20 MHz nonlicensed PCS band proposed in the Notice. Should the Commission ultimately decide to extend nonlicensed PCS spectrum, however, a very real issue industry and the Commission must address is reaccommodation of additional microwave users. This could present a substantial challenge as the population of microwave links and the associated reaccommodation

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[2] Operation of nonlicensed PCS devices also will not be confined to street level. Such operation could just as easily occur on the upper floors of a highrise office or residential building.

costs increase significantly as one moves outside the 1910-1930 MHz band segment proposed for nonlicensed PCS.

B. 900 MHz Narrowband PCS Bandplan

The Commission has proposed to allocate the 901-902, 930-931 and 940-941 MHz bands for narrowband PCS services and technologies. Motorola has long supported allocating spectrum for new narrowband PCS technologies. These technologies support a diverse range of new services with a combination of functionality and price unmatched by any other mobile service.

AMS (Advanced messaging services) is a major subgroup of the possible narrowband PCS services. It offers substantially increased benefits though the use of high speed transmission schemes and frequency re-use, facilitated by subscriber devices that contain low power transmitters, as well as high quality paging-type receivers. Such subscriber devices allow location and selection of only the base station necessary to complete the message rather than simulcasting the entire message from every base transmitter throughout the coverage area.

Such system designs allows more spectrally efficient use. The resultant additional system capacity can be used to serve more users and/or to provide more data to each user. Services such as E-mail, voice, and graphic images are enabled.

The cost and functionality advantages of messaging services and technologies are obvious with over 15 million paging users in the United States today.

The explosive growth of palm, laptop and portable computers is estimated at 50 percent annually. At the same time, recent growth in the electronic mail (E-mail) market exceeded 40 percent, with forecasted growth rates of 35% to continue for the next five years.

Recognizing that these trends will converge, manufacturers have begun offering devices specifically tailored to mobile E-mail needs, like the Hewlett-Packard HP95LX, the AT&T Safari, and the Apple Newton. Motorola, for example, recently unveiled the NewsCard, a one-way data modem for PCMCIA [3] compatible devices such as these. Future developments in battery, display, and microcomputer technology will further enhance the utility of portable devices which in turn will increase the demand for wide area narrowband PCS systems.

We encourage the Commission to finalize allocation and regulatory decisions without delay so Narrowband PCS services can be deployed now in the U.S. Other countries are moving ahead rapidly to develop narrowband PCS services and the traditional position of the U.S. as a leader could be lost. European Economic Community countries, for example, are expected to begin limited European Radio

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[3] PCMCIA refers to the Personal Computer Modem Card Interface Association which defines interface standards for these devices.

Messaging Service (ERMES) in early 1993, and Japanese companies are actively experimenting with one-way data facsimile service.

For these reasons, Motorola strongly supports the Commission's proposed allocation of spectrum for new narrowband PCS messaging services. One only need review any trade publication to see the revolution in wireless service offerings beginning to occur in the U.S. All that is necessary to proceed is spectrum.

Motorola generally supports the technical framework for new narrowband services as set forth in the Commission's Notice. Motorola believes, however, that spectral efficiency could be improved and infrastructure costs lowered, by adopting the following modifications based on the understanding of symmetrical and asymmetrical messaging coupled with the use of "quiet" 901-902 MHz spectrum. In addition, Motorola's plan substantially reduces interference that otherwise would result to adjacent land mobile operations in the 896-901 MHz band if the Commission were to authorize full powered base stations in the 901-902 MHz band as the proposed Narrowband PCS rules imply.

After reviewing a number of potential user applications, examining system proposals, and conferring with various industry representatives, Motorola believes that new narrowband PCS services will be both asymmetrical and symmetrical in nature. Asymmetrical messaging means that the capacity needed for talk-in (mobile-to-base) is less than that needed for talk-out (base-to-mobile).

There are many drivers towards asymmetry, largely due to the nature of how mobile devices interact with base stations. To demonstrate the unbalanced nature of narrowband services, Motorola has summarized a number of potential narrowband PCS applications in Table 1 that broadly involve transfer of information from and to mobile devices.

TABLE 1 -- MOBILE DATA APPLICATIONS	
Application	**Symmetry**
E-Mail • Origination • Reception • Forwarding • Annotation w/Forwarding	Outbound Weighted Overall • Device Limited Inbound • Long Outbound Documents • Inbound = ID+Addrs Only • Inbound = Annot+ID+Addrs Only
Data Inquiry/Response	Mostly Long Outbound
Infocast	Long Outbound Only
Link Sessions • Portable - Computer • Peer - Peer	Outbound Weighted Overall • Mostly Long Outbound • Mostly Short Symmetrical
Finder (Call me at.../Who has a...)	Outbound Weighted
Route (Where is...)	Symmetrical
Mall • Shopping (Tell me about...) • Purchase (Buy ... at $...)	Outbound Weighted Overall • Mostly Outbound • Short Inbound
Agent (Do this for me... Dispatch)	Mostly Outbound
Submit (Take this...)	Mostly Inbound

Several observations can readily be made about Table 1. Mobiles will desire to download remote database information, receive files from fixed users seeking to communicate with a mobile user, receive E-mail while on the move, or receive broadcast (i.e. point to multipoint) transmissions. These actions require short requests

to the base. Many mobile devices may simply transmit an acknowledgment just for location in order to conserve spectrum.

In other applications, data may be highly interactive and require connection to a local area network. Since asymmetrical data is likely to be the heaviest use of narrowband PCS spectrum, we have weighted the band plan accordingly to maximize spectrum efficiency.

The benefits of using 901-902 MHz as the talk in (mobile to-base) sub band are profound. 901-902 MHz is particularly suited to low power talk in because the bands that are adjacent to this segment today are mobile talk in for trunking systems on the low end and low power ISM on the high end. The infrastructure cost impact of having a "quiet" talk-in band are summarized in Table 2, which is based upon 20 db degradation in the base receiver due to just a single adjacent channel 1000 watt base transmitter one mile away.

TABLE 2 -- COST IMPACT OF 901-902 MHz TALK-IN BAND			
	901-902 MHz Talk-In	Mixed Talk-In/Out	Differential
# of Rcvrs	40	400	360 sites
	Monthly Recurring Costs		
Site Rental	$8,000	$80,000	$72,000
Line Costs	$6,000	$60,000	$54,000
Total	$14,000	$140,000	**$126,000**

Table 2 shows the reduction in talk in receiver sites required and the resultant better than 10 to 1 cost advantage by using the quiet 901 to 902 MHz segment for talk-in transmissions of Narrowband PCS devices.

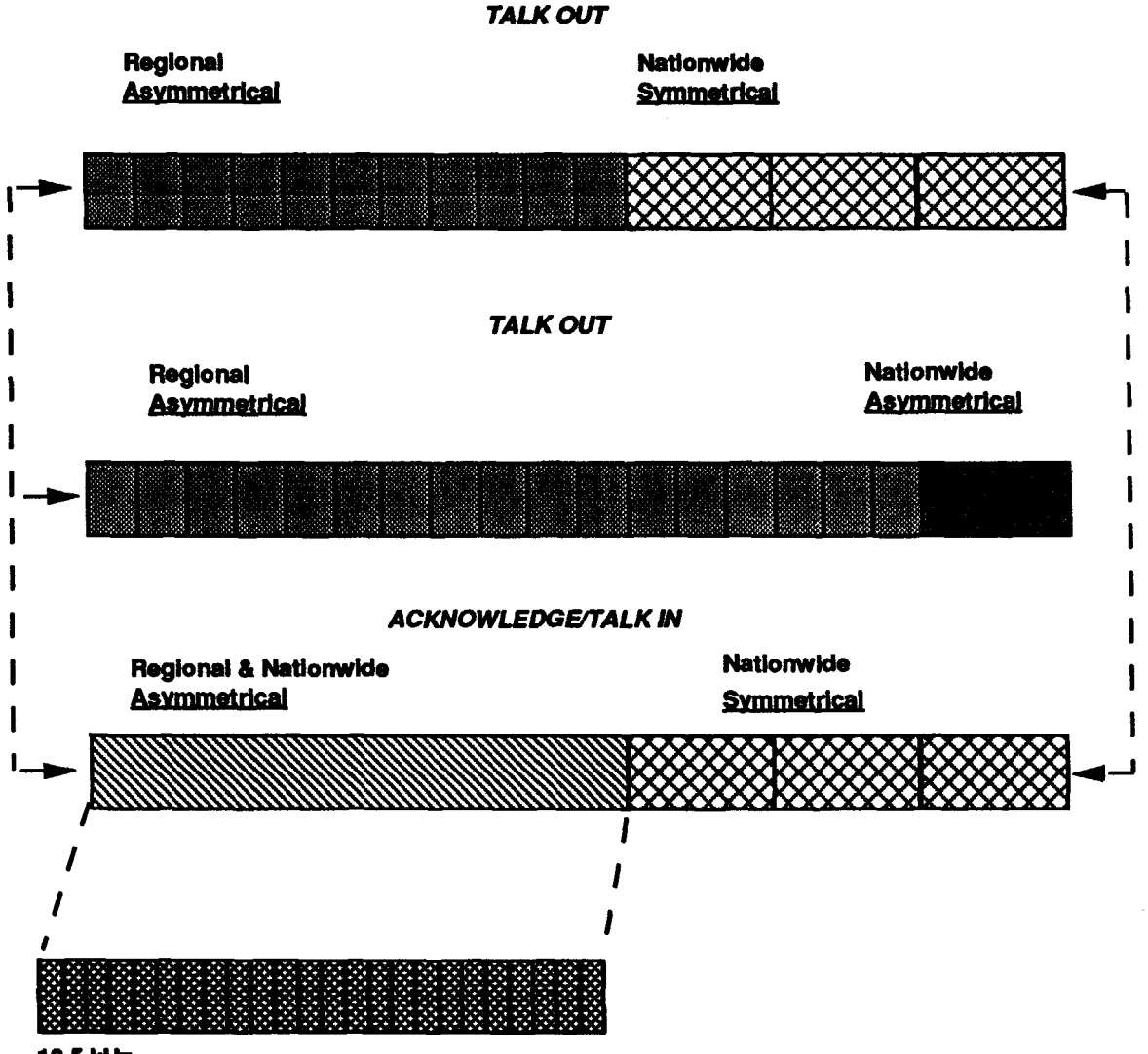
Based on the above, we propose 31 50 kHz channels in the base to mobile bands paired with 31 12. 5 kHz channels in the mobile-to-base band. We recommend establishing 3 of these channels for nationwide licensees and designating the remaining 28 channels for regional licensees.

Using this scheme the Commission could also make 13 12.5 kHz channels available by lottery to existing operators who wish to upgrade their systems to take advantage of the frequency reuse this pairing allows.

We further propose 3 blocks of 150 kHz in the 940-941MHz base to mobile band to be paired with 3 150 kHz blocks in the 901-902 MHz mobile to base band to allow for symmetrical traffic systems. The wider bandwidth of 150 kHz would allow for higher speed more interactive networks. We propose that these be national licenses because there is just not enough spectrum to create local, regional, and nationwide licenses for symmetrical services at 900 MHz. Motorola's recommended 900 MHz bandplan is attached as Figure 1.

It should be noted that by using the concept of asymmetrical pairing, a total of 31 50 kHz channels can be accommodated. If the Commission employ only

MOTOROLA PROPOSED NARROWBAND PCS BAND PLAN



940-941 MHz.

3, 150 kHz channels paired with 901

11, 50 kHz channels paired with 901 (12.5 kHz pieces)

930-931 MHz.

20, 50 kHz. channels paired with 901 (12.5 kHz pieces)

901-902 MHz.

44, 12.5 kHz. channels
31 automatic pairing with talk out,
13 available for existing systems.

3, 150 kHz channels paired with 940 channels

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FIGURE I

symmetrical pairing, i.e., both 50 kHz talk-in and 50 kHz talk-out, only 11 pairs could be accommodated. While telephony and some forms of data are largely symmetrical, most applications envisioned by the industry for Narrowband PCS can be supported by an asymmetrical bandplan. A key benefit of Motorola's plan is to match the regulatory structure to the services needed to serve greater numbers of users in a cost effective and spectrally efficient manner.

As a final matter, Motorola agrees with the Commission that a mix of regional and national systems should be authorized for 900 MHz narrowband systems, and that no provision need be made for exclusively local services. First, although the Commission's discussion of the benefits of larger service areas centers around factors affecting 2 GHz licensed operations, centralization costs incurred in cellular have also been evident in the paging industry, the predecessor to narrowband PCS services, ¶¶58-59.

Second, compared to 2 GHz services, vastly greater entry opportunities exist for providers to obtain narrowband PCS spectrum, and consequently smaller licensing areas would not significantly encourage diversity of services. Third, and most importantly, the demand research filed in ET Docket 92-100 demonstrates overwhelmingly that consumers require regional and national service. Under the circumstances, the argument for national and large regional licenses is significantly more pronounced for narrowband PCS than for 2 GHz PCS services, and Motorola believes only a mix of regional and national systems would be appropriate.

Using the Paging Industry as a benchmark, regional systems have experienced the most rapid growth. We believe that 5 regions would allow the geographic lines to be drawn that would keep co-channel interference caused by proximity of large cities to a minimum.

Motorola recommends maximum flexibility in technical choices for implementing Narrowband PCS, consistent with the band plan, and basic technical parameters such as power and emission mask specifications. In particular, the Commission may wish to allow licensees the flexibility to combine or split channels as long as they stay within their authorized spectrum. [4] If such flexibility is provided, power limits may need to be specified on a power per bandwidth basis. Further, Motorola recommends allowing both regional and nationwide licensees to use the same power density (watts/kHz) as existing 900 MHz nationwide paging operators. Subscriber unit power limit recommendations for 900 MHz Narrowband PCS are addressed in Section IV of these comments.

Additional specific modifications to the Narrowband PCS rules as proposed in the Notice are included as Appendix A. With Motorola's recommendations concerning bandplans and rules, potential users will be promptly rewarded with a broad variety of new Narrowband PCS services.

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[4] A similar approach is allowed for the 800 and 900 MHz private land mobile bands under Section 90.645 of the rules.

III. THE COMMISSION SHOULD GENERALLY RELY ON INDUSTRY STANDARDS BODIES FOR PCS TECHNICAL STANDARDS

In its Notice, the Commission proposed a variety of technical rules intending to provide interference protection to fixed microwave users and other PCS systems while affording significant flexibility for the continued design and implementation of PCS technologies, ¶¶104-130. Motorola strongly supports the decision to encourage the development and refinement of multiple PCS technologies. A single technology is unlikely to satisfy the wide variety of PCS services. It is more likely that multiple PCS concepts will be designed to serve the diversity of markets and needs. Therefore, the Commission should strive to implement neutral policies that do not unfairly favor a single technology but promote interoperability for the PCS user.

Standards will play a key role in ensuring that the development and introduction of multiple PCS technologies are presented to the marketplace in an orderly and beneficial manner. Standards that foster interoperability among competing systems are essential for creating consumer confidence in PCS. The Commission should therefore support and encourage the ongoing efforts of groups such as the Telecommunications Industries Association (TIA), T1, the technical committee of the Exchange Carriers Standards Association, Telocator and CTIA to develop common protocols and common air interfaces for various PCS technologies.

The following analysis reflects Motorola's comments and recommendations relating to the technical policies for 2 GHz licensed PCS devices as proposed by the Commission.

A. Licensed 1.8 GHz PCS System Interoperability

In its Notice, the Commission tentatively proposed to not require intersystem interoperability in order to afford each PCS licensee the flexibility to determine which PCS services are most needed and the most advantageous technologies for serving those needs, ¶130. The Commission did note, however, that it has been encouraged to expedite the industry standard setting process and has asked for comments on which specific standards may be ultimately beneficial, ¶108, n.79. Further, the Commission's goal of universality is best achieved through provisions for interoperability.

In response, Motorola concurs with the decision not to adopt a single transmission standard for PCS but emphasizes that interoperability is essential for consumer acceptance of PCS. If users cannot roam from one region to another, or even across competitive operators within the same region, universality and competition will be severely hampered. The first step in achieving universality is to require that only approved standardized CAI's be used for 1.8 GHz PCS. A multiplicity of proprietary protocols will limit consumer acceptance of public service such as PCS and will frustrate the goal of universal access.